FURTHER NOTES ON HYBRIDISATION IN THE GENUS EUCALYPTUS.

By J. H. Maiden, Government Botanist, and Director of the Botanic Gardens, Sydney.

Towards the end of 1903 I sent a paper* to the Australian Association for the Advancement of Science, which, through unavoidable causes was issued only in June, 1905. It was intended as a manifesto formally announcing my belief in hybridisation in the genus. Since that paper was written, and before it was published, I have taken various opportunities† of drawing attention to the subject, and the object of the present paper is to bring additional evidence before this Society.

I take the opportunity of emphasising the fact (related in detail under *E. Boormani*, *infra*) that the original discoverer of hybridisation in the genus was G. Caley, and he made his observation before 1810.

I also take the opportunity of recording that Mr. Walter Gill, Conservator of Forests, Adelaide, has informed me that he has held the opinion for over twenty years that Eucalypts hybridise.

How is a natural hybrid to be determined? I believe the following are guides:—

1. A natural hybrid is usually found in the neighbourhood of its reputed parents, and is always sparsely distributed.

2. In many cases the reputed hybrid, practically identical in character, is found in localities widely separated.

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* "On Hybridisation in the Genus *Eucalyptus*," Report Vol. x. (Dunedin Meeting, January, 1904). The paper contains several bibliographical references.

† *E.g.*, 'Critical Revision of the Genus *Eucalyptus*,' v. 140; vi. 164: 'Forest Flora of New South Wales': papers in these Proceedings. See also Victorian Naturalist, xxi. 114, 116.

3. The reputed parents must, of course, flower at the same time, and it must be borne in mind that there is considerable irregularity in the flowering periods of most species.

4. A hybrid possesses characters intermediate (not always strictly intermediate) between its two reputed parents.

5. Where species are closely related it is obviously more difficult to detect hybridism than where the parents have characters which readily contrast.

E. AMYGDALINA × CORIACEA.

E. vitellina Naudin (see these Proceedings, 1903, p.900) and *E. vitrea* R. T. Baker, are, in my opinion, closely related (perhaps identical) hybrids between *E. amygdalina* and *E. coriacea*. Naudin looked upon his species as a hybrid (and even suggested the above two parents). I have dealt with this form, and also the evidence for looking upon *E. vitrea* as a hybrid in my 'Critical Revision Genus *Eucalyptus*' (Part vi. pp.164-166).

E. OBLIQUA L'Hérit. var. ALPINA Maiden.

(*E. delegatensis* R. T. Baker); *E.obliqua* × *coriacea* (?).

It is possible that this interesting form may be a hybrid between *E. obliqua* and *E. coriacea*, but I am confronted with the difficulty that usually this form is not met with at so low an elevation as *E. obliqua*, as it appears to "succeed" *E. obliqua* in higher elevations. A reply to this, of course, would be that the hybrid once established it could have gradually become acclimatised to higher elevations.

E. BAILEYANA F.v.M.

I have evidence which tends to show that this species is probably a hybrid between *E. trachyphloia* F.v.M. (or *E. corymbosa* Sm.) and *E. Planchoniana* F.v.M. I am dealing with the matter in my 'Critical Revision,' so will not take up space here. The leaves and flowers have been described from a different tree from that carrying the characteristic fruits.

E. Consideneana Maiden.

In describing this form (these Proceedings, 1904, p.475) I have expressed the opinion that it may be a hybrid between *E. piperita* and *E. Siberiana*. In expressing this opinion I desire to make a note inculcating caution. It is sometimes difficult to properly assign the use of names, for the fact is all species have probably arrived at their present development largely by means of hybridism. The following will illustrate what I mean.

E. Consideneana probably has *E. piperita* and *E. Sieberiana* blood in its veins. We therefore might perhaps explain its position by saying that it is a hybrid between these two. But if *E. Consideneana* had been described *first*, it perhaps would not have occurred to botanists to describe, say, *E. piperita* as a hybrid of it.

Mr. Cambage and I found *E. Consideneana* in full bloom (Nov. 1904) and not rare near the 40-mile post on the road from Sydney, 4½ miles east of Springwood.

The Ironbark Boxes.

The Ironbarks and the Boxes appear to hybridise with facility. Following are some combinations of this class :—

E. Boormani Deane & Maiden.
(*E. siderophloia* × *hemiphloia*).

See a paper (these Proceedings, xxv. 111, 1900) 'On apparent hybridisation between *E. siderophloia* Benth., and *E. hemiphloia* F.v.M.' I desire to say that I have no doubt in my own mind as to *E. Boormani* being a hybrid between the species named.

Here I would draw attention to my paper 'George Caley, Botanical Collector in New South Wales, 1800-1810' in the Agric. Gazette, N. S. Wales (Oct. 1903, p.990). Caley gave the aboriginal name for *E. hemiphloia* as "Barilgora" or "Berigora," and "Derrobarry" and also "Burryagro" for *E. siderophloia*. Attached to a specimen of *E. Boormani* Caley makes the following statement—"'Burryagro.' A hybrid between 'Barilgora' and 'Derrobarry'!"

I made the following comment :—"The blacks had but one name for this, the Ironbark Box, and the Ironbark (*siderophloia*), but Caley saw that they were different. Caley's surmise at hybridisation in this case is marvellously shrewd." (See Proc. Linn. Soc. N. S. Wales, 1901, p.339).

It is only proper to emphasise Caley's discovery. He is undoubtedly the first man who wrote down a statement that hybridisation takes place in Eucalypts, which discovery is therefore a century old! Little is known in regard to Caley's scientific work, as he published little; and botanists do not clearly know what became of most of his specimens. Careful examination of his labels might show other important observations. At present I would submit that the discovery to which I have already alluded is a very valuable one, and he should be credited with it.

E. SIDEROXYLON × MELLIODORA.

I do not propose to give a hybrid a species-name if I am satisfied, as in the present case, it is a hybrid before I describe it. This particular hybrid was collected by myself and Mr. J. L. Boorman in May, 1902, near Murrurundi, N.S.W. Following is a copy of my notes made on the spot at the time—"Yellow cast of bark. A yellow box, though with some harder, more rugged bark at the butt (though little more so than the *melliodora* near), yet undoubtedly more a Yellow Box than an Ironbark. A very hard tough interlocked timber of a Box character, of a brown colour, not so yellow as typical *E. melliodora* sapwood usually is. Not a red timber like *sideroxylon* is. The wood is more like *hemiphloia*. At the same time the fruits, etc., are those of *E. sideroxylon*. The *E. sideroxylon* around is typical. Kino dots in bark as usual. Thin inner layer of bark as yellow as the proverbial guinea and like that of *melliodora*. Timber red and chippy, not interlocked. *E. melliodora* abundant in the vicinity."

As whether a tree is considered to be a hybrid or not must depend on the character of the neighbouring species, it is desirable, in collecting any unfamiliar forms, to take special note

of the species in the neighbourhood. For example, it is sometimes difficult to say whether a certain tree is *E. affinis* (*sideroxylon* × *hemiphloia* var. *albens*), or *E. sideroxylon* × *melliodora*, but the matter might be settled effectively if the surrounding Box were noted to be *E. hemiphloia* var. *albens* or *E. melliodora*.

E. sideroxylon is a species which readily hybridises, with the Boxes, at any rate. Some of the hybrids are so like *E. sideroxylon* that it is difficult to distinguish them unless the trees be seen, or a complete suite of specimens, including juvenile foliage, be available. *E. sideroxylon* has narrow juvenile foliage, and hence is readily seen to be different from a number of broad-foliaged trees more or less related to it.

E. SIDEROXYLON A. Cunn, and E. LEUCOXYLON F.v.M.

As I had seen specimens which, in my view, showed hybridism between *E. sideroxylon* A. Cunn., and *E. leucoxylon* F.v.M., I wrote to Mr. J. Blackburne, then Secretary of the National Forest League of Maryborough, Victoria, drawing his attention to the subject. In a few weeks he sent me four specimens from the Maryborough district.

No. 1 is typical *E. sideroxylon* A. Cunn., "Red Ironbark." Timber red, bark furrowed.

No. 4 is typical *E. leucoxylon* F.v.M., called by Mr. Blackburne "Smooth-barked Ironbark." Timber pale, bark smooth. I wrote to Mr. Blackburne in regard to his use of the term "Ironbark" for this species, it being often termed "White Ironbark" in Victoria, although there is often little or no "iron" bark. To this he replied, "I think Victorian writers in speaking of "*White Ironbark*" undoubtedly referred to *E. leucoxylon*. I know that Howitt did so. Another tree, *E. Sieberiana*, is sometimes alluded to as White or White-topped Ironbark, but I think you can rest assured that *E. leucoxylon* is the tree generally meant. *E. leucoxylon* is not altogether a *white wood*, although the heart wood is much *paler* in colour than *sideroxylon*."

His Nos. 2 and 3 he described in the following words :—

"No. 2 has a *thin, brown bark*, lighter in colour than No. 1, and not so deeply furrowed; the upper portion of the trunk and branches are smooth like No. 4."

"No. 3 has at the lower part of the stem or trunk the deeply furrowed, *dark-coloured bark* of No. 1, changing then for some feet into the type of No. 2 (thin and brown). Higher up it becomes thinner and flaky in texture. Upper portion of stem and branches like No. 4 (Gum top)."

He then adds:—"You will of course understand that Ironbark trees showing hybrid forms are not common in our young forest, being only occasionally met with."

I have received from Mr. Blackburne a complete suite of herbarium specimens, bark and timbers of these trees. They bear out his descriptions. Nos. 2 and 3 are intermediate between Nos. 1 and 4, and on these specimens alone I fail to see how the fact that *E. sideroxylon* and *E. leucoxylon* hybridise can be resisted.

E. LEUCOXYLON F.v.M., and (?) E. FASCICULOSA F.v.M.

Mr. Walter Gill, Conservator of Forests, Adelaide, sent me herbarium specimens, timber and bark of an aberrant tree from Kuitpo, S.A., with the following note—"I send you specimen of *E. leucoxylon* timber showing a very red heartwood which I have only seen in this district, the northern Blue Gum (*E. leucoxylon*) being all one colour."

The herbarium specimens are obviously strongly akin to those of *E. leucoxylon* F.v.M. (They also resemble those of *E. sideroxylon* A. Cunn., but I do not know an individual of that species nearer than some hundreds of miles). The timber is deep red and the bark is somewhat fibrous (Box-like), characters rarely present in *E. leucoxylon*. It seems reasonable to look upon this rare plant as a hybrid; and as to the other parent, Mr. Gill suggests *E. fasciculosa* as likely. The points in which these specimens differ from *E. leucoxylon* could be supplied by *E. fasciculosa*, a red-timbered species abundant locally.

E. AFFINIS Deane & Maiden, these Proceedings, 1900, p.104, with a plate.

In that paper some doubt was expressed as to the hybrid origin of *E. affinis*. I desire to say that I have now no doubt as to its hybrid origin. Others and myself have found it growing over large areas of country with *E. sideroxylon* and *E. hemiphloia* var. *albens*. The tree certainly is an intermediate between this species and variety, and I look upon these trees as its parents.

E. SIDEROXYLON A. Cunn. × WOOLLSIANA R, T. Baker, "Mallee Box."

I have evidence that these two species frequently hybridise. Mr. R. H. Cambage has drawn attention to these hybrids.* I have emphasised the matter,† adding the Cooburn or Black Box of the Narrabri district.

E. SIDEROXYLON A. Cunn. × FASCICULOSA F.v.M., "Mallee Box."

I believe these two species hybridise.

E. PANICULATA Sm. × HEMIPHLOIA F.v.M.

In these Proceedings (1901, p.340) Mr. Deane and I referred, though with some doubt, to a "Black Box" or "Ironbark Box" from Concord near Sydney. I desire to say that, having kept these trees under observation, I have no doubt as to their being hybrids of the species named.

E. POPULIFOLIA Hook. × FASCICULOSA F.v.M.

I believe these two species hybridise.

E. SALIGNA Sm. × ACACIÆFORMIS Deane & Maiden (?).

Mr. A. R. Crawford, Moona Plains, Walcha, sends me specimens with the following note—"No. 5. Supposed hybrid between *E. saligna* and *E. acaciæformis* (Black Peppermint).

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* These Proceedings, 1900, p.716.

† These Proceedings, 1904, p.763.

The tree is from 60-70 feet in height, rough-barked from the ground to within 5 or 6 feet or less of the smallest twig; in appearance the tree reminds me of the true *saligna*, although the bark resembles that of the 'Black Peppermint.'"

The fruits of this tree are intermediate in size and shape, and the buds intermediate in size and shape between those of *E. saligna* and *E. acaciæformis*. The suggestion as to the hybrid origin appears reasonable enough.

E. STUARTIANA F.v.M. × NOVA-ANGLICA Deane & Maiden (?).

Seven miles east of Walcha (J.H.M.) we have a tree with Peppermint bark all up the trunk (bark of *E. nova-anglica*). Suckers narrower than those of *E. Stuartiana*. Fruits smaller than, but near those of, *E. Stuartiana*. Foliage intermediate in character between that of *Stuartiana* and *nova-anglica*. I am inclined to think this is a case of hybridism.

E. PSEUDO-GLOBULUS (?) Naudin (or Trabut), see these Proceedings, 1903, p.899.

I have received specimens of this form from Dr. Trabut, with the note "feuilles très longues, fruits petits. Ne reproduit des graines." It seems to me a small-fruited form of *E. globulus*, more pedicellate than usual. It may be a hybrid, but I am not satisfied of this.

E. VIMINALIS Labill. var. MACROCARPA Rodway.

(*E. globulus* Labill. × *viminalis* Labill.).

Some time ago I expressed the opinion that the above form is identical with *E. Maideni* F.v.M.* Having received better seedlings from Mr. Rodway than I originally possessed, I incline to Mr. Rodway's view that it is nearer *viminalis*, and I also accept the view, which I resisted at the time, that it is a hybrid. Some of the juvenile foliage in my possession is coarser than any I have seen in *E. viminalis*, and I think that Mr. Rodway's

* Rept. Aust. Ass. Adv. Science (Hobart), ix. p.374 (1902).

statement that this form only occurs in plantations "of *E. viminalis* growing with *E. globulus* " is a sufficient explanation.

The seedlings of *E. Bäuerleni* F.v.M. (*E. viminalis* Labill. var. *Bäuerleni* Deane & Maiden) are identical with those of Mr. Rodway's variety. The fruits also have much in common, but those of Mr. Rodway are usually more domed. The rim of the junction of the calyx and operculum is very prominent in var. *Bäuerleni*; I have not ripe buds. The ripe buds of var. *macrocarpa* are rounded and glaucous.

The two forms (so called) of *E. viminalis*, viz., var. *macrocarpa* and var. *Bäuerleni*, are undoubtedly closely related. I think var. *macrocarpa* is a hybrid of *E. viminalis* × *globulus*. Whether var. *Bäuerleni* is also a hybrid I cannot say, but I incline to think it is, the parents being possibly *E. viminalis* and *E. Maideni* F.v.M.

E. KITSONI Luehmann, and E. NEGLECTA Maiden.

In describing* these two species, I have expressed the opinion that they are both hybrids of *E. Gunnii* Hook. f.

E. GOMPHOCORNUTA Trabut.

See my remarks in these Proceedings (1903, p.900). I have since received excellent specimens from Dr. Trabut. This plant is an interesting hybrid, of which *E. gomphocephala* is undoubtedly a parent. As to the other parent, I think it is less likely to be *E. cornuta* Labill., than *E. occidentalis* Endl. The characteristic bell-shape of the fruit of the latter species is well brought out in the specimens before me. Dr. Trabut's illustration (in Rev. Hort.) was made from fresh specimens; dried specimens show construction which accentuates the bell-shape.

E. ALGERIENSIS Trabut, Rev. Hort. de l'Algérie, Juin, 1904, p.146.

This is a species that Dr. Trabut looks upon as *E. rostrata* Schlecht. × *rudis* Endl., but he does not formally describe it.

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* ' Descriptions of two Victorian Eucalypts.' Vict. Nat. xxi. 112 (1904)

He states that it flowers abundantly in the spring, and its flowers have not the disagreeable odour of those of *E. rostrata*.

M. Trabut has been kind enough to send me twigs in bud, flower and early fruit of his species. I do not consider it sufficiently removed from the very variable *E. rudis* to warrant its being designated a new species. It is a broad-leaved form, but I have seen naturally grown *E. rudis* with leaves as broad. I do not see any evidence of admixture of *E. rostrata* in my specimens. As regards the leaves, an admixture of *E. rostrata* would tend to narrow them.

E. Kirtoniana F.v.M. (*E. patentinervis* R. T. Baker).

In my paper on hybridisation in this genus,* through an annoying misprint, the word "*rostrata*" has been substituted for "*robusta*." I look upon this form as *E. robusta* × *resinifera*.

* Rept. Aust. Ass. Adv. Science, 1904, p.302.